

1

PLASTIC PACKAGE WITH EXPOSED DIE AND METHOD OF MAKING SAME

This application is a divisional of Ser. No. 08/798,967,
filed Feb. 11, 1997 now U.S. Pat. No. 5,894,108 issued on
Apr. 13, 1999.

FIELD OF THE INVENTION

This invention relates to integrated circuit packages and in
particular to molded plastic packages.

BACKGROUND OF THE INVENTION

Several surface mounted package types are currently in
use, including plastic leaded chip carriers (PLCC), plastic
quad flat packs, small outline packages and ball grid array
(BGA) packages. Each package type supports an IC chip, or
"die", and provides interconnections between the die and a
printed circuit board (PCB).

FIG. 1 shows an example of a typical molded IC package
10. A lead frame 20 is the central supporting structure of the
molded IC package 10 to which all other elements are
attached. The lead frame 20 is etched or stamped from a thin
metal strip to form a pattern of narrow leads 22 radially
arranged around a central die attach platform 24 upon which
a die 30 is mounted via an epoxy resin 40. The die 30 has
a lower surface 32 contacting the epoxy resin 40 and an
opposing upper surface 34 facing away from the die attach
platform 24, and includes die bond pads 36 located on the
upper surface 34. The die bond pads 36 are electrically
connected to the leads 22 of the lead frame 20 by fine-
diameter gold wires 50 using well established wire bond
techniques. The lead frame 20, die 30 and wires 50 are
covered with a thermoset plastic casing 60 using an opera-
tion called transfer molding. As indicated in FIG. 1, the
plastic casing 60 includes an upper portion 62 formed over
and contacting the upper surface 34 of the die 30, and a
lower portion 64 formed under and contacting a lower
surface 25 of the die attach platform 24. After transfer
molding, leads 22 of lead frame 20 are plated, trimmed and
formed to complete the molded IC package 10.

A problem with conventional molded IC package 10 is
that, because the plastic casing 60 completely surrounds the
die 30, heat dissipation from the die 30 is resisted. More
specifically, the heat generated by the die 30 during normal
operation must pass through the upper portion 62 of the
plastic casing 60, and through the epoxy resin 40, die attach
portion 24 and lower portion 64 of the plastic casing 60. Due
to the insulating properties of the plastic casing 60, this heat
dissipation is resisted, thereby creating, in some instances,
high temperatures within the package 10 which can impair
or damage the die 30.

A second problem is the physical size (thickness) of the
conventional molded IC package 10. Specifically, the epoxy
resin 40, die attach platform 24 and lower portion 62 of the
plastic casing 60 substantially increase the overall thickness
of the conventional molded IC package 10.

A third problem associated with the conventional molded
IC package 10 is that the assembly process is complicated by
the steps of applying the epoxy resin 40 onto the die attach
platform 24, and then placing the die 30 onto the epoxy resin
40.

SUMMARY OF THE INVENTION

In accordance with the present invention, a plastic molded
package is provided which incorporates a lead frame struc-

2

ture surrounding a die and encased by a plastic material,
wherein a surface of the die and the lead frame are exposed
through a molded plastic casing, thereby exposing the die for
enhanced thermal performance. Further, the thickness of the
inventive package is reduced when compared with the
conventional plastic IC package (discussed above) because
the inventive package eliminates the die attach pad and
lower portion of the plastic casing which are used in the
conventional package. Moreover, the inventive package is
produced using a simplified assembly method in that the
steps of applying epoxy resin and mounting the die on the
die attach platform of the conventional package are elimi-
nated.

In accordance with the present invention, the lead frame
of the plastic molded package includes plurality of leads
extending radially away from the centrally-located die. The
die has an upper surface which is electrically connected to
an upper surface of the leads by wire bonding. A molded
plastic casing is formed over the die, wiring and lead frame
to encapsulate the package. Lower surfaces of the die and
lead frame are exposed through the plastic casing. To
increase the heat transfer rate, the package may be mounted
on a printed circuit board such that the die is mounted on a
heat sink structure.

Also in accordance with the present invention, a method
for producing a plastic molded package includes mounting
a die and a lead frame on an adhesive tape such that the lead
frame surrounds the die, wire bonding the die to the lead
frame, forming a molded plastic casing over the die, wire
bonding and lead frame, and, finally, removing the adhesive
tape to expose a lower surface of the die and the lead frame.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other features, aspects, and advantages of the
present invention will become better understood with the
following description, appended claims, and accompanying
drawings where:

FIG. 1 shows a cross-sectional view of a conventional
molded IC package;

FIGS. 2A and 2B are top and cross-sectional side views
of a lead frame in accordance with an embodiment of the
present invention;

FIG. 3 shows a cross-sectional side view of the lead frame
mounted on an adhesive tape;

FIG. 4 shows a cross-sectional side view of a die mounted
in a central opening of the lead frame;

FIG. 5 shows a cross-sectional side view of the die wire
bonded to the lead frame;

FIG. 6 shows a cross-sectional view of a molded plastic
casing formed over the assembly of FIG. 5; and

FIG. 7 is a section view of a plastic molded package in
accordance with the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 7 shows a section view of an electronic device 100
incorporating a plastic package formed in accordance with
the present invention.

Referring to FIG. 7, the device 100 incorporates a sub-
stantially flat lead frame 110 having an upper (first) surface
112 and an opposite lower (second) surface 114. The lead
frame 110 includes a plurality of radial leads 115 extending
from a central opening 118. An integrated circuit die 120 is
located in the central opening of the lead frame 110 such that